[Suggested changes to this section address all discovered issues except the do not fully address the allowed heat pump type and associated sizing sections in C406.2.6.]

C406.1 Additional energy efficiency and load management measures credit requirements. The project as defined in the building permit shall meet the following requirements as applicable:

1. New buildings ((~~and~~)), changes in *space conditioning category*, change of occupancy group, and building additions in accordance with Chapter 5 shall comply with sufficient ((~~packages~~)) measures from ((~~Table C406.1~~)) Section C406.2 so as to achieve ((~~a~~)) the minimum number of ((~~6~~)) required efficiency credits shown in Table C406.1.

2. New buildings greater than 5000 gross square feet of floor area shall comply with sufficient measures from Section C406.3 so as to achieve the minimum number of required load management credits shown in Table C406.1.

3. Tenant spaces shall comply in accordance with Section C406.1.1.

4. Projects using discrete area credit weighting shall comply in accordance with Section C406.1.2.

EXCEPTIONS:

1. Low energy spaces in accordance with Section C402.1.1.1 ((~~and~~)), equipment buildings in accordance with Section C402.1.2 ((~~shall~~)), unconditioned spaces, open parking garages, and enclosed parking garages that comply with sufficient ((~~packages~~)) measures from Table ((~~C406.1~~)) C406.2 to achieve a minimum ((~~number of 3~~)) of ~~24~~ 50% of the efficiency credits required for new construction. Such projects shall be exempt from the load management requirements in Table C406.1.

2. Building additions that have less than 1,000 square feet of *conditioned floor area* ((~~shall~~)) that comply with sufficient ((~~packages~~)) measures from Table ((~~C406.1~~)) C406.2 to achieve a minimum ((~~number of 3~~)) of ~~24~~ 50% of the efficiency credits required for new construction~~efficiency credits~~.

3. Warehouses are exempt from the load management credit requirements in Table C406.1.

Table C406.1

((~~**Efficiency Package Credits**~~))

Energy Measure Credit Requirements

Commented [MK1]: 24 is roughly half of the number of credits required for these space types in new construction. But for additions 24 credits is either the same (with GP-136) or more (wo GP-136) than the required credits in the new All other category. Additions will have to comply with more efficiency credits than required for new construction.

This should have some sort of adjustment at least if GP-136 is included. Adjusted to be 50% of the credits required for New construction

Commented [MK2]: 24 is higher than required by the with GP-136 numbers. Needs to be adjusted.

Required Credits for Projects	Section	Occupancy Group					
	Group R-1	Group R-2	Group B	Group E	Group M	All Other	
New building energy efficiency credit requirement	C406.2	54	41	42	48	74	49
Building additions energy efficiency credit requirement	C406.2	27	20	21	23	36	21
If proposal 21-GP-136 is not included in the final adoption, then replace the two rows above with the following two rows:							
New building energy efficiency credit requirement	C406.2	68	80	48	55	84	49
Building additions energy efficiency credit requirement	C406.2	33	40	24	27	41	24
New building load management credit requirement	C406.3	12	15	27	15	13	26

C406.1.1 Tenant spaces. An initial tenant improvement shall comply with sufficient ((~~packages~~)) measures from Table ((~~C406.1~~)) C406.2 to achieve a minimum ((~~number of six~~)) of efficiency credits required in Table C406.1 and are not required to achieve any load management credits. In ((~~buildings~~)) projects with multiple tenant spaces, each tenant space is permitted to apply for different ((~~packages~~)) measures provided the weighted average of all areas in the ((~~building~~)) project.

C406.1.1.1 Applicable envelope ((~~**and**~~))**, ~~on-site~~ renewable and elevator energy credits.** Where an entire building or building addition complies with Section ((~~C406.5, C406.10 or C406.11~~)) C406.2.4, C406.2.9, C406.2.10, or C406.2.14, under an initial tenant improvement permit, tenant spaces within the building qualify for the number of credits assigned to the occupancy ((~~type~~)) group of the tenant space in accordance with Table ((~~C406.1~~)) C406.2. Where prior energy credits

Commented [RH3]: Headings need to move 1 column right

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were achieved under the 2018 Washington State Energy Code, they shall be multiplied by 6 for applicability to this code.

C406.1.1.2 Applicable HVAC and service water heating credits. Where HVAC and service water heating systems and services are installed and comply with Section ((~~C406.2 or C406.8~~)) C406.2.4, C406.2.9, C406.2.10, or C406.2.14 under an initial tenant improvement permit, those systems and services shall be considered a part of the tenant space. Tenant spaces qualify for the credits assigned to the occupancy ((~~type~~)) group of the tenant space in accordance with Table ((~~C406.1~~)) C406.2 if the tenant space includes the distribution system and equipment that the central HVAC systems or service water heating systems were designed to support.

((~~EXCEPTION: Previously occupied tenant spaces in existing buildings that comply with this code in accordance with Section C501.~~))

C406.1.2 Discrete area-weighted projects. Discrete building areas shall be permitted to achieve credits using different measures provided that the whole project complies with both the energy and load management credit requirements. Compliance shall be determined as follows:

1. Project credit requirement shall be the individual occupancy group requirements from Table C406.1 for each discrete area weighted by discrete area *conditioned floor area*. Where one occupancy group is less than 10% of the floor area of the project, use the primary occupancy group for all credits.

2. Determine the energy and load management credits achieved for each discrete area based on its occupancy group. Where envelope or lighting power credits in Sections C406.2.3.1, C406.2.3.2, or C406.2.3.12 are used, then the lighting power or envelope UA percentage reduction shall be calculated for the project as a whole to determine achieved credits.

3. Determine project credits achieved by weighting individual discrete area credits by discrete area *conditioned floor area*.

Commented [MK4]: One issue here was that an area could qualify from the LPD measure but the same decreased LPD could be being used to allow more LPD in other areas of the building. Envelope would be the same. The credit area needs to coincide with the same area used for the lighting compliance.

Commented [RH5]: This is not perfect, but I think covers it without getting into a bunch of formulas.

Commented [MK6]: Agree

4. A project complies when both energy and load management credits are equal to or greater than the weighted project requirement.

AMENDATORY SECTION (Amending WSR 20-21-080, filed 10/19/20, effective 2/1/21)

~~**WAC 51-11C-40602 Section C406.2 ((HVAC option.)) Additional energy efficiency credit measures. C406.2 Additional energy efficiency credit measures.** Each energy efficiency credit measure used to meet credit requirements for the project shall include efficiency that is greater than the energy efficiency required for the building type and configuration requirements in Sections C402 through C405. Measures installed in the project that meet the requirements in Sections C406.2.1 through C406.2.14 shall achieve the credits listed for the measure and occupancy group in Table C406.2 or where calculations required by Sections C406.2.1 through C406.2.14 create or modify the table credits, the credits achieved shall be based upon the section calculations.~~

Commented [MK7]: Repeat of text below

NEW SECTION

WAC 51-11C-40620 Section C406.2—Additional energy efficiency credit measures. C406.2 Additional energy efficiency credit measures. Each energy efficiency credit measure used to meet credit requirements for the project shall include efficiency that is greater than the energy efficiency required for the building type and configuration requirements in Sections C402 through C405. Measures installed in the project that meet the requirements in Sections C406.2.1 through C406.2.14 shall achieve the credits listed for the measure and occupancy group in Table C406.2 or where calculations required by Sections C406.2.1 through C406.2.14 create or modify the table

credits, the credits achieved shall be based upon the section calculations.

Table C406.2

Efficiency Measure Credits

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
1. Dwelling unit HVAC control	C406.2.1	NA	7	NA	NA	NA	NA
2. Improved HVAC TSPR[a]	C406.2.2.1	NA	8	11	17	22	NA
3. Improve cooling and fan efficiency	C406.2.2.2	2	~~1~~2	~~2~~3	~~2~~4	3	2
4. Improve heating efficiency	C406.2.2.3	2	3	3	10	16	7
5. Low-carbon district energy system (45% annual district-system-net-load-met)	C406.2.2.4	3	3	4	11	17	8
6. Improved low-carbon district energy system (50% annual district-system-net-load-met)[b]	C406.2.2.5	9	10	12	33	52	24
7. High performance DOAS	C406.2.2.6	31	31	21	39	40	21/ (A) 40[c]
8. Fault detection & diagnostics (FDD)	C406.2.2.7	2	2	2	6	9	4
9. 10% reduced lighting power	C406.2.3.1	7	4	18	16	20	15
10. 20% reduced lighting power[d]	C406.2.3.2	13	8	36	32	40	29
11. Lamp efficacy improvement	C406.2.3.3	5	6	NA	NA	NA	NA
12. Residential lighting	C406.2.4.1	NA	8	NA	NA	NA	NA

Commented [RH8]: Increased slightly for a few building types based on revised analysis

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
control							
13. Enhanced lighting control	C406.2.4.2	1	1	6	6	11	6
14. Renewable energy	C406.2.5	7	12	13	13	10	11
15. Shower drain heat recovery	C406.2.6.1	9	30	NA	3	NA	NA
16. Service water heat recovery	C406.2.6.2	35	111	13	14	(Grocery) 41[e]	NA
17. Heat pump water heating	C406.2.6.3	NA	NA	17	33	(Grocery) 95[g]	(A-2) 95[f]
Note: If proposal 21-GP1-136 is not included in the final WSEC, then replace the row above with the following:							
17. Heat pump water heating	C406.2.6.3	81	261	17	33	(Grocery) 95[e]	(A-2) 95[f]
18. Heat trace system	C406.2.7.1	6	13	4	1	NA	6
19. Point of use water heater	C406.2.7.2	NA	NA	19	5	NA	NA
20. Service hot water distribution right sizing	C406.2.8	13	42	NA	NA	NA	NA
21. High performance service hot water temperature maintenance system	C406.2.9	TBD	TBD	TBD	TBD	TBD	TBD
22. High efficiency service hot water circulation system	C406.2.10	3	6	2	1	NA	4
23. Low flow residential showerheads	C406.2.11	3	3	NA	NA	NA	NA
24. Enhanced envelope performance[g]	C406.2.12	24	20	13	5	19	14
25. Base reduced air ~~infiltration[g]~~leakage[g]	C406.2.13.2	29	24	6	3	9	11
26. Enhanced reduced	C406.2.13.3	53	44	11	5	16	20

Commented [MK9]: C403.9.2.3 requires heat recovery to water in grocery over 40000SF.

Commented [RH10R9]: C403.9.2.3 allows recovery to "or" 3 conditions, including SWH in smaller groceries, so we just modified the footnote.

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
air ~~infiltration[g]~~leakage[g]							
27. Enhanced commercial kitchen equipment	C406.2.14	30[h]	18[h]	18[h]	30[h]	30[h]	31[h]
28. Enhanced residential kitchen equipment	C406.2.15	12	19	NA	NA	NA	NA
29. Enhanced residential laundry equipment	C406.2.16	NA	6	NA	NA	NA	NA
30. Heat pump clothes dryers	C406.2.17	6	6	NA	NA	NA	NA
31. Efficient elevator equipment	C406.2.18	3	5	5	5	4	4

[a] Projects using Item 2 shall not use Items 3 through 5.

[b] Projects using C406.2.2.5 shall not use C406.2.2.4.

[c] For C406.2.2.6, occupancy Group A achieves 40 credits while other occupancy groups within the "all other" category achieve 21 credits.

[d] Projects using C406.2.3.2 shall not use C406.2.3.1.

[e] Service water heat recovery and heat pump water heating are available in Group M only for grocery stores larger than 10,000 ft^2. Large mixed retail with full grocery and butcher sections shall achieve half the credits. This credit not available where refrigeration recovery to heat service hot water is used to meet the requirements of C403.9.2.3.

[f] Heat pump water heating efficiency credits are available in the "all other" category only for Group A-2.

[g] Buildings or building areas that are exempt from the thermal envelope requirements in accordance with Sections C402.1.1 and C402.1.2, do not qualify for this package.

[h] Additional energy efficiency credits, up to the maximum shown in Table C406.2, shall be calculated according to Section C406.2.11.

[]

NEW SECTION

WAC 51-11C-40621 Section C406.2.1—Dwelling unit HVAC measures. C406.2.1 Dwelling unit HVAC controls. HVAC systems serving *dwelling units* or *sleeping units* shall be controlled with a programmable

thermostat that is configured to automatically activate a setback condition of at least 5°F (3°C) for both heating and cooling. The programmable *thermostat* shall be configured to provide setback during occupied sleep periods. The unoccupied setback mode shall be configured to operate in conjunction with one of the following:

1. A manual main control device by each *dwelling unit* main entrance that initiates setback for all HVAC units in the *dwelling unit* and is clearly identified as "Heating/Cooling Master Setback."

2. Occupancy sensors in each room of the *dwelling unit* combined with a door switch to initiate setback for all HVAC units in the dwelling within 20 minutes of all spaces being vacant immediately following a door switch operation. Where separate room HVAC units are used, an individual occupancy sensor on each unit that is configured to provide setback shall meet this requirement.

3. An advanced learning thermostat that senses occupant presence and automatically creates a schedule for occupancy and provides a dynamic setback schedule based on when the spaces are generally unoccupied.

4. An automated control and sensing system that uses geographic sensing connected to the *dwelling unit* occupants' cell phones and initiates the setback condition when all occupants are away from the building.

[]

NEW SECTION

WAC 51-11C-40622 Section C406.2.2—HVAC measures. C406.2.2 More efficient HVAC system performance. All heating and cooling systems shall meet the minimum requirements of Section C403 and efficiency improvements shall be referenced to the minimum efficiency requirements listed in the tables in Section C403.3.2. Where multiple efficiency requirements are listed, equipment shall meet the seasonal efficiencies including SEER, EER/IEER, IPLV or AFUE. Equipment that is

larger than the maximum capacity range indicated in the tables in Section C403.3.2 shall utilize the values listed for the largest capacity equipment for the associated equipment type shown in the table. Where multiple individual heating or cooling systems serve the project, the improvement shall be the weighted average improvement based on individual system capacity.

For occupancies and systems required to comply with Section C403.1.1, credits are ~~permitted to be~~ achieved by meeting the requirements of Section C406.2.2.1. Other systems are permitted to achieve credits by meeting the requirements of either:

1. Section C406.2.2.2, More efficient HVAC equipment cooling and fan performance.
2. Section C406.2.2.3, More efficient HVAC equipment heating performance.
3. Section C406.2.2.4, High performance dedicated outdoor air system (DOAS).
4. Any combination of Sections C406.2.2.2, C406.2.2.3, and C406.2.2.4.

In addition, energy credits are permitted to be achieved for Section C406.2.2.~~5~~7, ~~Fault~~ fault detection and diagnostics~~, where not otherwise required by Section C403.2.3 or C403.6.10(15~~16~~)~~.

Commented [MK11]: Strange wording. I would delete "permitted to be"

Commented [RH12]: This clause is redundant with exclusion language in C406.2.2.7, so I would delete it here

C406.2.2.1 Improved HVAC TSPR. For systems required to comply with Section C403.1.1, the *HVAC TSPR* shall exceed the minimum requirement by five percent. If improvement is greater, the credits in Table C406.2 are permitted to be prorated up to a 20 percent improvement.

C406.2.2.2 More efficient HVAC equipment cooling and fan performance. No less than 90 percent of the total HVAC capacity serving the total *conditioned floor area* of the entire building, building addition or tenant space in accordance with Section C406.1.1 shall comply with Sections C406.2.2.2.1 through C406.2.2.2.3. Where individual equipment efficiencies vary, weigh them based on capacity.

C406.2.2.2.1 HVAC system selection. Equipment installed shall be types that are listed in the tables in Section C403.3.2.

C406.2.2.2.2 Cooling equipment efficiency. Equipment shall exceed the minimum cooling efficiency requirements listed in the tables in Section C403.3.2 by at least 5 percent. Where equipment exceeds the minimum annual cooling efficiency and heat rejection efficiency requirements by more than 5 percent, energy efficiency credits for cooling shall be determined using Equation 4-15, rounded to the nearest whole number.

(Equation 4-15)

$$EEC_{HEC} = EEC_5 \times \left[1 + \frac{CEI - 5\% \; 0.05}{5\% \; 0.05}\right]$$

Where:

EEC_{HEC} = Energy efficiency credits for cooling efficiency improvement.

EEC_5 = Section C406.2.2.2 credits from Table C406.2.

CEI = The lesser of the improvement above minimum cooling efficiency requirements, minimum heat rejection efficiency requirements, or 20 percent (0.20). Where cooling efficiency varies by system, use the capacity weighted average efficiency improvement for all cooling equipment combined. ~~Where cooling rating reduces as efficiency increases, base t~~The CEI efficiency improvement ~~on the inverse of the rating~~ expressed as a fraction shall be determined one of the following ways:~~.~~

For metrics that increase as efficiency increases, CEI shall be calculated as follows:

$$CEI = \frac{CM_{DES}}{CM_{MIN}} - 1$$

For metrics that decrease as efficiency increases, CEI shall be calculated as follows:

$$CEI = \frac{CM_{MIN}}{CM_{DES}} - 1$$

Commented [RH13]: Normalized to a fraction rather than percent, as following efficiency improvements are expressed as fractions

Commented [RH14]: The following additions simply specify how CEI is determined, as it could be calculated 3 different ways with 3 different answers. Also addresses that the efficiency metric is different for difference classes of equipment.

where:

CM_{DES} = Design cooling efficiency metric, part-load or annualized where available

CM_{MIN} = Minimum required cooling efficiency metric, part-load or annualized where available from Section C403.3.2

For Data Centers using Standard 90.4, CEI shall be calculated as follows:

$$\text{CEI} = \frac{AMLC_{MAX}}{AMLC_{DES}} - 1$$

where:

$AMLC_{DES}$ = As-Designed Annualized Mechanical Load Component calculated in accordance with Standard 90.4, Section 6.5

$AMLC_{MAX}$ = Maximum Annualized Mechanical Load Component from Standard 90.4, Table 6.5

C406.2.2.2.3 Minimum fan efficiency. Where fan energy is not included in packaged equipment rating or it is and the fan size has been increased from the as-rated equipment condition, fan power or horsepower shall be less than 95 percent of the allowed fan power in Section C403.8.1.

C406.2.2.3 More efficient HVAC equipment heating performance. No less than 90 percent of the total HVAC capacity serving the total *conditioned floor area* of the entire building, building addition or tenant space in accordance with Section C406.1.1 shall comply with Sections C406.2.2.3.1 through C406.2.2.3.2.

C406.2.2.3.1 HVAC system selection. Equipment installed shall be types that are listed in the tables in Section C403.3.2. Electric resistance heating shall be limited to ~~20~~ 10 percent of system capacity, with the exception of heat pump supplemental heating.

C406.2.2.3.2 Heating equipment efficiency. Equipment shall exceed the minimum heating efficiency requirements of the tables in Section C403.3.2 by at least 5 percent. Where equipment exceeds the minimum annual heating efficiency requirements by more than 5 percent, energy

Commented [MK15]: Is it clear that equipment outside the size bounds is okay here?

Commented [RH16R15]: I think the word "type" answers that question

Commented [MK17]: This is less stringent than WSEC 2018 which only allowed 10%. Not sure this is a fair change at this stage but I don't think this was noticed in the TAG stage.

efficiency credits for heating shall be determined using Equation 4-16, rounded to the nearest whole number.

(Equation 4-16)

$$EEC_{HEH} = EEC_5 \times \left[1 + \frac{\text{~~CH~~EI} - \text{~~5%~~ } 0.05}{\text{~~5%~~ } 0.05}\right]$$

Where:

EEC_{HEH}	Energy efficiency credits for heating efficiency improvement.
EEC_5	Section C406.2.2.2 credits from Table C406.2.
~~CEI~~HEI	The lesser of the improvement above minimum heating efficiency requirements or 20 percent (0.20). Where heating efficiency varies by system, use the capacity weighted average percentage for all heating equipment combined. For metrics that increase as efficiency increases, EI_{heat} shall be calculated as follows:

$$HEI = \frac{HM_{DES}}{HM_{MIN}} - 1$$

where:

HM_{DES} = Design heating efficiency metric, part-load or annualized where available

HM_{MIN} = Minimum required heating efficiency metric, part-load or annualized where available from Section C403.3.2

EXCEPTION: In low energy spaces complying with Section C402.1.1 and *semi-heated spaces* complying with Section C402.1.1.2, no less than 90 percent of the installed heating capacity is provided by electric infrared or gas-fired radiant heating equipment for localized heating applications. Such spaces shall achieve credits for EEC_5.

C406.2.2.4 Low-carbon district energy systems. Not less than 90 percent of the annual service hot water and space heating load, or not less than 90 percent of the annual service hot water, space heating, and space cooling load shall meet the criteria of Section C406.2.2.4.1 or C406.2.2.4.2.

Documentation for the low-carbon district system that is operational prior to the final inspection shall be provided to demonstrate that the definition of *low-carbon district energy exchange system* is satisfied.

C406.2.2.4.1 Low-carbon district energy exchange systems. Low-carbon district energy exchange systems must demonstrate the following:

1. ~~1.~~ Forty-five percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources and no more than 25 percent of the annual
2. heat input to the system comes from fossil fuel or electric-resistance sources.

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C406.2.2.4.2 Low-carbon district energy heating and cooling or heating only systems. Distribution losses must be accounted for and may not exceed 5 percent of the annual load delivered to buildings served by the system. *Low-carbon district energy heating and cooling or heating only systems* must demonstrate one of the following:

1. Forty-five percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources and no more than 25 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources.

2. No more than 10 percent of the system annual heat input to the system comes from fossil fuels or electric-resistance sources. The remaining annual heat input must be provided using heat pump technology with a minimum annual operating COP of 3.0.

C406.2.2.5 Improved low-carbon district energy systems. Not less than 90 percent of the annual service hot water and space heating load, or not less than 90 percent of the annual service hot water, space

heating, and space cooling load shall meet the criteria of Section C406.2.2.5.1 or C406.2.2.5.2.

Documentation for the low-carbon district system that is operational prior to the final inspection shall be provided to demonstrate that the definition of *low-carbon district energy exchange system* is satisfied.

C406.2.2.5.1 Low-carbon district energy exchange systems. Low-carbon district energy exchange systems must demonstrate the following:

1. Fifty percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources and no more than 10 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources.

C406.2.2.5.2 Low-carbon district energy heating and cooling or heating only systems. Distribution losses must be accounted for and may not exceed 5 percent of the annual load delivered to buildings served by the system. *Low-carbon district energy heating and cooling or heating only systems* must demonstrate one of the following:

1. Fifty percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources and no more than 10 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources.

2. No more than 10 percent of the system annual heat input to the system comes from fossil fuels or electric-resistance sources. The remaining annual heat input must be provided using heat pump technology with a minimum annual operating COP of 4.0.

C406.2.2.6 High performance dedicated outdoor air system (DOAS). No less than 90 percent of the total conditioned floor area of the whole project, excluding floor area of unoccupied spaces that do not require

ventilation as specified by the *International Mechanical Code*, shall be served by DOAS installed in accordance with Section C403.3.5 with the following adjustments:

1. Minimum heat recovery sensible effectiveness of 80 percent, calculated in accordance with Section C403.3.5.1.

2. Where design outdoor airflow is greater than 500 cfm (250 L/s), the DOAS shall be equipped with an economizer bypass, damper control, or wheel speed control that is active between 55°F (13°C) and 75°F (24°C)outdoor air temperature and minimizes energy recovery or maintains an appropriate DOAS leaving air temperature when the building is generally in cooling, based either on outdoor air temperature or a DDC zone-based cooling system reset.

3. DOAS total combined fan power shall be less than either:

3.1. 0.769 W/cfm (1.55 W/L/s) when calculated in accordance with Section C403.3.5.2.

3.2. Eighty percent of fan power allowance for a constant volume system when calculated in accordance with Section C406.8.1.

This option is not available to areas served by systems utilizing Section C403.2.2.1 exception 5.

C406.2.2.7 Fault detection and diagnostics system. A project not required to comply with Section C403.2.3 or C403.6.10(~~15~~16) shall achieve energy credits for installing a fault detection and diagnostics system to monitor the HVAC system's performance and automatically identify faults. The installed system shall comply with items 1 through 6 in Section C403.2.3.

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Commented [RH18]: Incorrect ref

NEW SECTION

WAC 51-11C-40623 Section C406.2.3—Lighting measures. C406.2.3 Reduced lighting power. Interior lighting within the whole project shall achieve credits by complying with Section C406.2.3.1 or

C406.2.3.2. In Group R-1 and Group R-2 occupancies, dwelling and sleeping units shall comply with C406.2.3.3 and all other areas in the Group R-2 occupancy shall comply with Section C406.2.3.1 or C406.2.3.2. Credits apply to the whole Group R1 or Group R-2 area.~~lighting power reduction applies to the entire R-1 or R-2 occupancy group area. *Dwelling units* and *sleeping units* within the building shall achieve credits by complying with Section C406.2.3.3~~.

C406.2.3.1 Reduced lighting power option 1. The total connected interior lighting power calculated in accordance with Section C405.4.1 shall be 90 percent or less of the lighting power values specified in Table C405.4.2(1) times the floor area for the building types, or 90 percent or less of the total interior lighting power allowance calculated in accordance with Section C405.4.2.

C406.2.3.2 Reduced lighting power option 2. The total connected interior lighting power calculated in accordance with Section C405.4.1 shall be 80 percent or less of the lighting power values specified in Table C405.4.2(1) times the floor area of the building types, or 80 percent or less of the total interior lighting power allowance calculated in accordance with Section C405.4.2.

C406.2.3.3 Lamp efficacy. No less than 95 percent of the permanently installed light fixtures in dwelling units and sleeping units shall be provided by lamps with a minimum efficacy of 90 lumens per watt.

C406.2.4 Lighting controls. For buildings with nontransient *dwelling units* and *sleeping units*, energy credits shall be achieved by installation of systems that comply with the requirements of Section C406.2.4.1. All other buildings shall achieve energy credits by complying with Section C406.2.4.2. For buildings with mixed occupancies, credits shall be prorated based on floor area.

C406.2.4.1 Residential building lighting control. In buildings with nontransient *dwelling units* and *sleeping units*, lighting controls shall be configured to meet the following:

Commented [MK19]: Clarify treatment of Group R dwelling and sleeping units

Commented [MK20]: Bad number should be C406.2.3.3

1. Each *dwelling unit* or *sleeping unit* shall have a main control by the main entrance that turns off all the lights and switched receptacles in the unit. The main control shall be permitted to have two controls, one for permanently wired lighting and one for switched receptacles. The main controls shall be clearly identified as "lights master off" and "switched outlets master off."

2. Switched receptacles shall be clearly identified and all switched receptacles shall be located within 12 inches of an unswitched receptacle. Each room shall have a minimum of two switched receptacles except bathrooms, kitchens, and closets.

C406.2.4.2 Enhanced digital lighting controls. Measure credits shall be achieved where no less than 50 percent of the gross floor area within the project has luminaires and lighting controls that include high end trim in compliance with Section C405.2.8.3 and either *luminaire-level lighting controls* in compliance with Section C405.2.8.1 or networked lighting controls in accordance with Section C405.2.8.2. Where *general lighting* in more than 50 percent of the gross floor area complies, the base credits from Table C406.2 shall be prorated as follows:

[~~Tuned lighted floor area~~Floor area with high end trim, %] x [Base energy credits for C406.2.4.2] / 50%

[]

Commented [MK21]: C405.2.3 is manual control. High end trim is C405.2.8.3.

Commented [MK22]: Tuned lighted floor area doesn't connect to anything in the code. Either the reference in the section should mention "tuned in accordance with" or Perhaps the term here should change to Floor area with high end trim or something.

NEW SECTION

WAC 51-11C-40624 Section C406.2.5—Renewable energy measures.

C406.2.4 On-site and off-site renewable energy. Projects installing on-site or off-site renewable energy systems with a capacity of at least 0.1 watts per gross square foot (1.08 W/m^2) of building area in addition to the renewable energy capacity required elsewhere in this code shall achieve energy credits for this measure. Renewable energy systems achieving energy credits shall not be used to satisfy other

requirements of this code. . Credits shall be prorated from the table value in accordance with Equation 4-17.

(Equation 4-17)

$$AEC_{RRa} = AEC_{0.1} \times \left[\frac{RR_t - RR_r}{0.1 \times PGFA}\right] \times REF$$

$$AEC_{RRa} = AEC_b \times \frac{(\sum REF \times RR_t) - RR_r}{RR_b \times PGFA}$$

Where:

AEC_{RRa} = Section C406.2.5 achieved energy credits for this project as calculated in accordance with Equation 4-17, limited to 50 percent of the required credits in Section C406.1.

RR_t = Actual total rating of on-site and off-site renewable energy systems (W) for each type of renewable energy source in Table C411.3.1.

RR_r = Rating of ~~on-site~~ renewable energy systems required by Section C411.1, other sections in this code, or used to qualify for exceptions in this code (W).

RR_b = Rating of renewable energy systems required to achieve base credits, 0.1 W/square foot (1.08 W/m^2).

PGFA = ~~The lesser of the improvement above minimum heating efficiency requirements or 20 percent. Where heating efficiency varies by system, use the capacity weighted average percentage for all heating equipment combined.~~Project gross floor area, square feet (m^2)

$AEC_{0.1b}$ = Section C406.2.5 base credits from Table C406.2.

REF = Renewable Energy Factor from Table C411.3.1.

Informative Note: On-site renewable energy may include thermal service water heating or pool water heating, in which case ratings in Btu/h can be converted to W where W = Btu/h / 3.413.

Commented [RH23]: Corrected for SI units and to account for multiple types of renewable in the building

Commented [RH24]: This table reference may change or be corrected elsewhere, it is the table: "Multipliers for Renewable Energy Procurement Methods"

Commented [RH25]: This may change, it is the "multipliers for Renewable Energy Procurement Methods" table

NEW SECTION

WAC 51-11C-40625 Section C406.2.6—Service water measures.

C406.2.6 Reduced energy use in service water heating. Buildings with service hot water heating equipment that serves the whole building, building addition or tenant space shall achieve credits through compliance with either:

1. Section C406.2.6.1, C406.2.6.2, or C406.2.6.3.
2. Section C406.2.6.1 and Section C406.2.6.2 ~~or C406.2.6.3~~.
3. Section C406.2.6.1 and Section C406.2.6.3.

Commented [RH26]: Clarifies, you can always do drain recovery alone or with the other measures, then you can either do energy recovery or HPWH

C406.2.6.1 Shower drain heat recovery. Shower drain heat recovery units shall comply with Section C404.10 and preheat cold water supply to the showers. ~~Portable~~Potable waterside pressure loss shall be less than 10 psi (69 kPa) at maximum design flow. The efficiency of drain water heat recovery units shall be 54 percent in accordance with CSA B55.1. Full credits are applicable to the following building use types: Multi-family, hotel, motel, dormitory, and schools with locker room showers. Where not all showers in the project have drain heat recovery, the credit is adjusted based on the following:

[Section C406.2.6.1 table credits] x [Showers with drain recovery] / [Total number of showers]

C406.2.6.2 Service water heating energy recovery. Not less than 30 percent of the annual service hot water heating energy use, or not less than 70 percent of the annual service hot water heating energy use in buildings with water-cooled chiller systems subject to the requirements of Section C403.9.2.1 or qualifying for one of its exceptions, shall be provided by one or more of the following:

1. Waste heat recovery from service hot water, heat recovery chillers, building equipment, process equipment, or other *approved* system. Qualifying heat recovery must be above and beyond heat recovery required by other sections of this code.
2. On-site renewable energy water-heating systems where not used to meet other requirements or to obtain other energy credits.

OPTION 1 for Section C406.2.6.3 (if 136/HP water heating is not adopted)

C406.2.6.3 Heat pump service water heating. Projects shall achieve credits through compliance with Section C406.2.6.3.1 or C406.2.6.3.2.

C406.2.6.3.1 Heat pump water heater. Credit shall be achieved where service hot water system capacity is 82,000 Btu/h (24kW) or less and is served using ~~air source~~ heat pump technology with no more than 4.5 kW of resistance supplemental heating and meets one of the following:

1. The COP rating for air source heat pumps will be ~~with~~ a minimum COP of 3.0 and reported at the design leaving heat pump water temperature with an entering air temperature of 60°F (16°C) or lower. For water-source equipment, the COP rating will be reported at the design leaving load water temperature with an entering source (non-potable) water temperature of 74°F (23°C) or lower.

2. The uniform energy factor (UEF) shall be a minimum of 3.40 rated based on U.S. Department of Energy requirements.

C406.2.6.3.2 Central heat pump service water heating. Energy credits shall be achieved where service hot water ~~shall be~~is provided by an electric ~~air source~~ heat pump water heating (HPWH) system meeting the requirements of Sections C406.2.6.3.1 through C406.2.6.3.2.5. ~~Supplemental service water heating equipment is permitted to use electric resistance in compliance with Section C404.2.1.4~~.

C406.2.6.3.2.1 Primary heat pump system sizing. The system shall include a primary service output of 100 percent load at 40°F (4°C) dry bulb or wet bulb outdoor air temperature for air-source heat pumps, or 44°F (7°C) ground temperature for ground-source heat pumps that provides sufficient hot water as calculated using the equipment manufacturer's selection criteria or another *approved* methodology. Electric air source heat pumps shall be sized to deliver no less than 50 percent of the calculated demand for hot water production during the peak demand period when entering dry bulb or wet bulb outdoor air temperature of 24°F (-4°C).

Commented [RH27]: Seems pretty clear water source was wanted since it is handled in the later text

Commented [MK28]: Not really clear to me. Air source is here, air source and water source are in item 1, and air source and ground source are in **C406.2.6.3.2.4. If this is opened up then need water source dealt with in all sections. Watersource is not so great unless it is tied to most of the year cooling loads such as a data center. I see air, ground, and ground water source as far beyond water source in terms of efficiency.**

Commented [MK29]: Is it clear which entering water temp this is? Would be good to get better terminology here. Load-side and source-side to follow the trane and Colmac lingo, or are both of these load side?

Commented [RH30R29]: Or potable; actually, I think the intent was both of these temps were the potable side, thinking average tank temp is 74, and design is ~120. The source side is likely to be much colder than 74F. I have completely different specs we wrestled out for IECC, so maybe this needs to go back to Frankel.

Commented [MK31]: The framing of 74 or lower would imply that you get less efficiency at lower temps which would be true of source water but not load water.

Commented [MK32]: Double "shall be" is weird. This should be is.

Commented [MK33]: Same air source water source conflict

Commented [MK34]: This is covered in **C406.2.6.3.2.4 which is referenced above. And t**his section will not exist if 136 is not passed which is what this section is supposed to be. **Delete this and rely on the fact that C406.2.6.3.2.4 is required.**

C406.2.6.3.2.2 Primary hot water storage sizing. The system shall provide sufficient hot water to satisfy peak demand period requirements.

C406.2.6.3.2.3 System design. The service water heating system shall be configured to conform to one of the following provisions:

1. For *single-pass* HPWHs, *temperature maintenance* heating provided for reheating return water from the building's heated water circulation system shall be physically decoupled from the primary service water heating system storage tank(s) in a manner that prevents destratification of the primary system storage tanks. *Temperature maintenance* heating is permitted to be provided by electric resistance or a separate dedicated heat pump system.

2. For *multi-pass* HPWHs, *recirculated temperature* maintenance water is permitted to be returned to the primary water storage tanks for reheating.

3. Unitary HPWHs located in conditioned space are permitted, where they are sized to meet all calculated service water heating demand using the heat pump compressor~~, and not~~ without supplementary heat.

C4064.2.6.3.2.3.1 Mixing valve. A thermostatic mixing valve capable of supplying hot water to the building at the user temperature setpoint shall be provided, in compliance with requirements of the *Uniform Plumbing Code* and the HPWH manufacturer's installation guidelines. The mixing valve shall be sized and rated to deliver tempered water in a range from the minimum flow of the *temperature maintenance* recirculation system up to the maximum demand for the fixtures served.

C406.2.6.3.2.4 Supplemental water heating. Total supplemental electric resistance water heating equipment shall not have an output capacity greater than the primary water heating equipment at 40°F (4°C) entering dry bulb or wet bulb outdoor air temperature for air-source heat pumps or 44°F(7°C) ground temperature for ground-source heat

Commented [MK35]: English. Drop comma and change to "without supplementary heat"

Commented [MK36]: numbering

pumps. Supplemental electric resistance heating is permitted for the following uses:

1. *Temperature maintenance* of heated-water circulation systems, physically separate from the primary service water heating system. *Temperature maintenance* heating capacity shall be no greater than the primary water heating capacity at 40°F (4°C) dry bulb or wet bulb outdoor air temperature for air-source heat pumps or 44°F (7°C) ground temperature for ground-source heat pumps.

2. Defrost of compressor coils.

3. Heat tracing of piping for freeze protection or for *temperature maintenance* in lieu of recirculation of hot water.

4. Backup or low ambient temperature conditions, where all of the following are true:

4.1. The supplemental heating capacity is no greater than the primary service water heating capacity at 40°F (4°C) dry bulb or wet bulb outdoor air temperature for air-source heat pumps or 44°F (7°C) ground temperature for ground-source heat pumps.

4.2. During normal operations the supplemental heating is controlled to operate only when the entering air temperature at the air-source HPWH is below 40°F (4°C), and the primary HPWH compressor continues to operate together with the supplemental heating when the entering air temperature is between 17°F (-8°C) and 40°F (4°C).

4.3. The primary water heating equipment cannot satisfy the system load due to equipment failure or entering air temperature below 40°F (4°C).

C406.2.6.3.2.5 Alarms. The control system shall be capable of and configured to send automatic error alarms to building or maintenance personnel upon detection of equipment faults, low leaving water temperature from primary storage tanks, or low hot water supply delivery temperature to building distribution system.

OPTION 2 for Section C406.2.6.3 (if 136/HP water heating is adopted)

Commented [MK37]: Main section text says system must be air source heat pump. Delete this or change main text. If water source allowed need to add water source here.

C406.2.6.3 Heat pump service water heating. Projects shall achieve credits through compliance with Section C406.2.6.3.1.

C406.2.6.3.1 Heat pump water heater. Credit shall be achieved where service hot water system capacity is 82,000 Btu/h (24kW) or less and is served using ~~air-source~~ heat pump technology with no more than 4.5 kW of resistance supplemental heating and meets one of the following:

1. The COP rating will be with a minimum COP of 3.0 and reported at the design leaving heat pump water temperature with an entering air temperature of 60°F (16°C) or lower. For water-source equipment, the COP rating will be reported at the design leaving load water temperature with an entering load water temperature of 74°F (23°C) or lower.

2. The uniform energy factor (UEF) shall be a minimum of 3.40 rated based on U.S. Department of Energy requirements.

C406.2.~~6.~~7 Improved service hot water temperature maintenance. For buildings with gross floor area greater than 10,000 square feet, credit shall be achieved when hot water temperature maintenance is installed in accordance with Section C406.2.7.1 or C406.2.7.2.

C406.2.7.1 Self-regulated heat trace system. The credit achieved shall be from Table C406.2. This system shall include self-regulating electric heat cables, connection kits and electronic controls. The cable shall be installed directly on the hot water supply pipes underneath the insulation to replace standby losses.

C406.2.7.2. Point of use water heater. The credit achieved shall be from Table C406.2 where any fixtures requiring hot water shall be supplied from a localized electric source of hot water with no recirculation or heat trace and limited to 2 kW and 6 gallons of storage. The supply pipe length from the point of use water heater to the termination of the fixture supply pipe shall be no more than 20 feet.

C406.2.8 Service hot water distribution right sizing. To achieve this credit, where Group R-1 and R-2 occupancies are served by a central

Commented [MK38]: Same comment here. This says air source but text of item one talks about water-source.

Commented [RH39]: Fix numbering

service hot water system, the distribution system serving *dwelling units*, *sleeping units* and guestrooms shall be sized using Appendix M of the *Uniform Plumbing Code*.

C406.2.9 High performance service hot water temperature maintenance system. Systems with multiple riser service hot water circulation systems shall use only heat pump technology for temperature maintenance. ~~Service hot water system delivering heating requirements shall use~~ The heat pump technology ~~with~~ shall have a minimum COP of 3.0 or UEF of 3.4. For air-source equipment, the COP rating will be reported at the design leaving heat pump water temperature with an entering dry bulb air temperature of 60°F (16°C) or lower and a relative humidity of 50 percent or lower. For water-source equipment, the COP rating will be reported at the design leaving load water temperature with an entering water temperature of 74°F (23°C) or lower. The system shall comply with the requirements of Section C404.7.1.

Commented [MK40]: What does this mean? Needs edit.

Commented [MK41]: Maybe change load to load side and then adjust the other to source side.

Commented [RH42R41]: I think 74 is also potable load side

C406.2.10 High efficiency service hot water circulation system. Multiple riser service hot water circulation systems shall use a variable volume circulation pump controlled to vary the pump speed based on system demand and shall include self-actuated thermostatic balancing valves to control the system flow at each riser.

C406.2.11 Low flow showerheads for Group R-1 and R-2 occupancies. All showerheads installed in Group R-1 and R-2 *dwelling units* or *sleeping units* shall have a maximum listed flowrate of 1.25 gallons per minute or less at 80 psi operating pressure for fixed showerheads and a maximum listed flowrate of 1.50 gallons per minute or less at 80 psi operating pressure for handheld showerheads. When a shower is served by more than one showerhead, including handheld showerheads, the combined flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 1.25 gallons per minute or less for fixed or 1.5 gallons per minute or less for handheld, or

the shower shall be designed to allow only one shower outlet to be in operation at a time.

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NEW SECTION

WAC 51-11C-40626 Section C406.2—Envelope measures. C406.2.12 Enhanced envelope performance. The Proposed~~al~~ Total UA of the thermal envelope of the project shall be 15 percent lower than the Allowable Total UA determined ~~for an area of identical configuration and fenestration area~~ in accordance with Section C402.1.5 and Equation 4-2.

C406.2.13 Reduced air ~~infiltration~~leakage. Energy credits shall be achieved where measured air ~~infiltration~~ leakage of the total *conditioned floor area* of the whole building, fully isolated building addition or tenant space is determined in accordance with Section C402.5.1.2 ~~C406.13.1~~ and complies with the maximum leakage in either Section C406.2.13.~~2~~1 or C406.2.13.~~3~~2.

~~**C406.2.13.1 Air leakage testing and verification.** Air infiltration shall be verified by whole building pressurization testing conducted in accordance with ASTM E779 or ASTM E1827 by an independent third party. The measured air leakage rate of the building thermal envelope shall not exceed the specified maximum air leakage in cfm/ft^2 (L/s per m^2) under a pressure differential of 0.3 in. water gauge (75 Pa), with the calculated surface area being the sum of the above and below grade *building thermal envelope*. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the code official and the building owner.~~

~~EXCEPTION: Where the *conditioned floor area* of the building is not less than 250,000 ft^2 (25,000 m^2), air leakage testing shall be permitted to be conducted on representative above grade sections of the building provided the *conditioned floor area* of tested areas is no less than 25 percent of the *conditioned floor area* of the building and are tested in accordance with this section.~~

Commented [MK43]: Proposed.

Commented [MK44]: ? Not sure what this says. It seems like this is defined in C402.1.5 and doesn't need to be here. What is needed is a limit when component performance is used so that this credit is calculated for the same area used in the component performance calc.

Commented [RH45R44]: This language carried forward from the old code without change.

Commented [MK46]: Your fix that this measure be project wide solves this and the deletion here is good.

Commented [RH47]: I think it is best to reference the testing section rather than have a redundant (and different) one. Also use a percentage change, as there are different test methods now for outdoor facing dwelling units.

Formatted: Space Before: 6 pt

C406.2.13.~~2~~ 1 Base reduced air leakage~~infiltration~~. Measured air ~~infiltration~~ leakage ~~determined in accordance with Section C406.13.1~~ shall not exceed ~~0.17 cfm/ft² (0.86 L/s per m²)~~68 percent of the maximum leakage allowed by Section C402.5.1.2.

C406.2.13.~~3~~ 2 Enhanced reduced air leakage~~infiltration~~. Measured air ~~infiltration determined in accordance with Section C406.13.1~~leakage shall not exceed 33 percent of the maximum leakage allowed by Section C402.5.1.2~~0.08 cfm/ft² (0.41 L/s per m²)~~.

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Commented [MK48]: 0.08 rather than 0.8

Commented [RH49R48]: Changing to a percentage avoids these slip ups.

NEW SECTION

WAC 51-11C-40627 Section C406.2—Other measures. C406.2.14 Enhanced commercial kitchen equipment. For buildings or areas designated as Group A-2, or facilities whose primary business type involves the use of a commercial kitchen with at least one gas or electric fryer, all fryers, dishwashers, steam cookers and ovens shall comply with all of the following:

1. Achieve the ENERGY STAR label in accordance with the specifications current as of January 1, 2022, or a later edition.

2. Be installed prior to the issuance of the certificate of occupancy.

3. Have the ENERGY STAR qualified model number listed on the construction documents submitted for permitting.

Energy efficiency credits for efficient commercial kitchen equipment shall be determined based on Equation 4-19, rounded to the nearest whole number.

(Equation 4-19)

$$AEEC_K = 20 \times \frac{Area_K}{Area_B}$$

Where:

$AEEC_K$	=	Section C406.2.14 table credits, to a maximum of those allowed in Table C406.2 for this option.
$Area_K$	=	Floor area of full-service kitchen (ft^2 or m^2).
$Area_B$	=	Gross floor area of building (ft^2 or m^2).

C406.2.15 Residential kitchen equipment. For projects with Group R-1 and R-2 occupancies, energy credits shall be achieved where all dishwashers, refrigerators and freezers comply with all of the following:

1. Achieve the ENERGY STAR Most Efficient ~~2021~~ label in accordance with the 2022 specifications or later edition. ~~in accordance with the specifications current as of:~~

~~1.1. Refrigerators and freezers: 5.0, 9/15/2014.~~

~~1.2. Dishwashers: 6.0, 1/29/2016.~~

2. Be installed prior to the issuance of the certificate of occupancy.

For Group R-1 where only some guestrooms are equipped with both refrigerators and dishwashers, the table credits shall be prorated as follows:

[Section C406.2.15 table credits] x [Floor area of guestrooms with kitchens] / [Total guestroom floor area]

C406.2.16 Residential laundry appliances. For projects with Group R-2 occupancies, energy credits shall be achieved where all clothes washers and dryers in the project meet the following requirements:

Commented [MK50]: In 2025, will new equipment even be listed in the 2021 list. At a minimum update to 2022 as it exists. But suggest this be changed to "most recent" or add "or later edition". The listing embodies specific critera so the versions and dates on 1.1 and 1.2 seem unneeded and likely to go out of date at some point.

Commented [MK51]: Like lighting need to make clear if this is limited to units or whether credit is for entire Group R occupancy. Not one thing I've been seeing is that mechanical engineers are assuming anything in a multifamily is Group R but the office and most amenity spaces would not be Group R..

Commented [MK52]: Same as above. Are these credits just for the unit areas, all of the group R occupancy, or something else.

1. Each dwelling unit contains in-unit washing washer and dryer equipment that meets the following requirements:

1.1. Achieve the ENERGY STAR Most Efficient label in accordance with the ~~2021~~ 2022 specifications or a later edition.

1.2. Be installed prior to the issuance of the certificate of occupancy.

2. Where only some dwelling units are equipped with both washers and dryers, the table credits shall be prorated as follows:

[Section C406.2.16 table credits] x [Floor area of dwelling units with laundry] / [Total dwelling unit floor area]

C406.2.17 Heat pump clothes dryers. All domestic clothes dryers located in Group R-1 and R-2 of the whole project are ENERGY STAR rated heat pump dryers. Credit applies only to buildings where laundry facilities are provided either ~~heat pump dryers are~~ within each residential dwelling or sleeping units, ~~or~~ grouped together in central multi-family use laundry rooms, or a mix of the two.~~.~~

To ~~qualify to~~ claim this credit, the building permit drawings shall specify the ~~option being selected and shall show the~~ appliance type and provide documentation of ENERGY STAR compliance. At the time of inspection, all appliances shall be installed and connected to utilities.

C406.2.18 Efficient elevator equipment. Qualifying elevators in the building shall be Energy Efficient Class A in accordance with ISO 25745-2, Table 7. Only buildings three or more floors above grade shall be permitted to use this credit. Credits shall be prorated based on Equation 4-18, rounded to the nearest whole credit. Projects with a compliance ratio (CRe in Equation 4-18) below 0.5 do not qualify for this credit.

(Equation 4-18)

Commented [MK53]: The building I'm looking at now has some of both, it's not all in the units. As written a building with some units with laundry and some without with a common laundry could claim this with the common HP dryer even though the unit dryers were not heat pumps.

All units with HP or common areas with Heat pumps

Commented [MK54]: Redundant. Should be To qualify for, or to claim but not both.

Commented [MK55]: Needs to be defined. Easiest to reference the formula. Maybe with a (CRe) or (CRe in Equation 4-18)

$$EC_e = EC_t \times CR_e$$

Where:

EC_e = Elevator energy credit achieved for building.

EC_t = Section C406.2.18 table energy credit.

$CR_e = \frac{F_A}{F_B}$

F_A = Sum of floors served by Class A elevators.

F_B = Sum of floors served by all building elevators and escalators.

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WAC 51-11C-40630 Section C406.3—Load management credits.

C406.3 Load management credits. Load management measures installed in the building that meet the requirements in Sections C406.3.1 through C406.3.7 shall achieve the credits listed for the occupancy group in Table C406.3 or where calculations required by Sections C406.3.1 through C406.3.7 create or modify the table credits the credits achieved will be based upon the section calculations.

Each load management measure shall ~~required~~ requir~~ing~~e automatic controls activated by either utility demand response, utility price response signal, peak price period time control, or local building

demand monitoring ~~shall~~to ~~be capable of performing the described load management practices~~. Controls shall be capable of and configured to provide the required load management sequences. The following additional ~~control systems~~ requirements apply to these measures:

1. Where credit is taken for C406.3.6, service water heating energy storage, the equipment shall be provided with controls that comply with ANSI/CTA 2045-B.

2. For ~~other~~ load management measures in Sections C406.3.1 through C406.3.5:

2.1. Where the serving utility has a real-time demand response or pricing program, an interface compliant with serving utility requirements shall be installed.

2.2. Where the serving utility does not have a real-time demand response or pricing program, a digital input to the system to support future utility programs shall be installed and building demand monitoring shall be installed and integrated into the load management sequence.

2.3. All equipment involved in the required load management sequence shall have controls connected to a central DDC system.

Commented [MK56]: Something is wrong with this sentence. Reworded

Commented [RH57R56]: I would go with shall require

Commented [MK58]: Is there really a difference between practices and sequences. Pretty confusing to me. Cleaned up.

Commented [RH59]: C406.3.6 and C406.3.7 have their own control requirements.

Table C406.3

Load Management Measure Credits

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
1. Lighting load management	C406.3.1	12	15	27	15	NA	NA
2. HVAC load management	C406.3.2	29	24	42	23	13	26
3. Automated shading	C406.3.3	NA	7	12	16	NA	NA
4. Electric energy storage	C406.3.4	41	50	126	72	37	65
5. Cooling energy storage	C406.3.5	13	10	14	19	NA	14
6. Service hot water energy storage	C406.3.6	31	248	59	8	5	70
7. Building thermal mass	C406.3.7	NA	NA	50	95	96	80

C406.3.1 Lighting load management. Automatic controls shall be capable of gradually reducing general lighting power with continuous dimming in 75 percent of the building area by at least 20 percent during peak demand periods. Where less than 75 percent, but at least 50 percent, of the building area lighting is controlled, the credits from Table C406.3 shall be prorated as follows:

$$\frac{[\textit{Area of building with lighting load management}, \%] \times [\textit{Table credits for } \text{C406.3.1}]}{75\%}$$

EXCEPTION: Warehouse or retail storage building areas shall be permitted to achieve this credit by switching off at least 25 percent of lighting power in 75 percent of the building area without dimming.

C406.3.2 HVAC load management. Automatic controls shall:

1. Where electric cooling is used, be configured to gradually increase, over a minimum of three hours, the cooling setpoint by at least 3°F ~~over the course of~~ during the coincident summer peak building load and peak price or demand periods.

2. Where electric heating is used, be configured to gradually reduce, over a minimum of three hours, the heating setpoint by at least 3°F during winter peak pricing or building peak demand periods.

C406.3.3 Automated shading load management. Where fenestration on south and west exposures exceeds 20 percent of the wall area, automatic controls shall be configured to operate movable exterior shading devices or dynamic glazing to reduce solar gain through sunlit fenestration on southern and western exposures by at least 50 percent during electrical summer peak periods.

Informative Note: This credit can be met by exterior roller, movable blind or movable shutter shading devices; however, fixed overhang, screen or shutter shading will not meet the requirement. Roller shades that reject solar gain but still allow a view are allowed as long as they provide an effective 50 percent reduction in net solar gain (e.g., have a shading coefficient of less than 0.5 for the shading material itself). Interior shading devices will not meet the requirement. Electrochromatic windows that achieve 50 percent of SHGC would qualify.

C406.3.4 Electric energy storage. Automatic controls shall store electricity in electric storage devices during nonpeak periods and use stored energy during peak periods to reduce building demand. Electric storage devices shall have a minimum capacity of 5 Wh/ft^2 (58 Wh/m^2) of

Commented [MK60]: Confusing. To many overs. "During" as used in number 2 is better.

gross building area. For greater storage capacity up to 15 Wh/ft^2 (160 Wh/m^2), credits shall be prorated as follows:

$$\frac{\text{[Installed electric storage capacity, Wh/ft}^2\text{]}}{5\ (58)\times\text{[C406.3.4 credits from Table C406.3]}}$$

C406.3.5 Cooling energy storage. Automatic controls shall be capable of activating ice or chilled water storage to reduce electric demand. The equipment shall also be capable of responding to ~~during the~~ hours of summer peak ~~electric prices~~cooling. Credits shown in Table C406.3 are based on storage capacity of twice the design day peak hour ~~2 ton-hours per design day ton of colling~~cooling load with a 1.15 sizing factor. Credits shall be prorated for installed storage systems sized between 0.5 and 3.5 times the design day peak hour ~~ton-hours per design day ton of~~ cooling load rounded to the nearest whole credit. The storage tank shall have no more than 1.5 percent of storage capacity standby loss per day.

C406.3.6 Service hot water energy storage. To achieve this credit, where service hot water is heated by electricity, automatic controls activated by utility demand response signal, peak price period time control, or local building demand monitoring shall preheat stored service hot water before the peak demand or peak price period and suspend electric water heating during the peak period ~~of peak prices coincident with peak building load~~. Storage capacity shall be provided by either:

1. Preheating water above 140°F (60°C) delivery temperature with at least 1.34 kWh of energy storage per kW of water heating capacity. Tempering valves shall be provided at the water heater delivery location.

2. Providing additional heated water tank storage capacity above peak service hot water demand with equivalent peak storage capacity to item 1.

C406.3.7 Building thermal mass. To achieve this credit, the building shall have both additional passive interior mass and a night-flush

Commented [MK61]: Are we really distinguishing "summer peak electric prices" from "peak periods to reduce building demand". In this case it should be related to peak cooling since we don't have peak prices only a demand charge.

Commented [MK62]: cooling

Commented [MK63]: do we really want design day ton and ton-hours here or should it just be a factor applied to installed or design cooling capacity.

Commented [RH64R63]: It is ton-hours per ton; it is design day rather than installed chiller capacity, as that may be much less with storage.

Commented [MK65]: We don't have peak prices. Needs to be redone somehow.

Commented [RH66R65]: I think "or" covers it, someday there may be peak pricing. I have verified that PGE & Pacific Power have done some optional time of use pricing schedules

control of the HVAC system. This credit is only available to projects that have at least 80% of gross floor area unoccupied between midnight and 6:00 a.m. The project shall have the following characteristics:

1. Interior to the *building thermal envelope* insulation, provide 15 pounds of passive thermal mass per square foot of building floor area. Mass construction shall be in the building interior and the indoor facing portion of the exterior wall, and interior floor construction. Mass construction shall have mass surfaces in direct contact with the air in conditioned spaces with directly attached wall board or hard surface flooring allowed. Mass with carpet or furred wallboard shall not be counted toward the building mass required. For integral insulated concrete block walls complying with ASTM C90, only the mass of the interior face shall be counted toward the building mass required.

~~2. When summer mode is active and indoor average temperature is 5°F (3°C) or more above outdoor temperature and between 10:00 p.m. and 6:00 a.m., automatic night flush controls shall operate outdoor air economizers at low fan speed less than 66 percent during the unoccupied period until the average indoor air temperature falls to the occupied heating setpoint. Summer mode shall be activated when outdoor air exceeds 70°F (21°C) and continues until deactivated when outdoor air falls below 45°F (7°C). Another night flush strategy shall be permitted where demonstrated to be effective, avoids added morning heating and is *approved* by the *code official*.~~

[The following is an alternative more detailed sequence for paragraph 2 above; is has the same stringency]

2. HVAC units for 80% or more of the supply airflow in the project shall be equipped with outdoor air economizers and fans that have variable or low speed capable of operating at 66% or lower airflow and be included in the night flush control sequence. Night flush controls shall be configured with the following sequence:

Commented [MK67]: Too many ands in this. Summer mode and 5F and 10-6. Sort of confusing. Maybe delete the "and"

Commented [RH68R67]: See more detailed alternate sequence highlighted below

Commented [RH69]: The following alternative wording of the above sequence has the same intention and stringency, but more clarity.

2.1. Summer mode shall be activated when outdoor air temperature exceeds 70°F (21°C) and shall continue uninterrupted until deactivated when outdoor air temperature falls below 45°F (7°C). During summer mode, the occupied cooling set point shall be set 1°F (0.6°C) higher than normal and the occupied heating set point shall be reset 2°F (1.1°C) lower than normal.

2.2. When all the following conditions exist, the night flush condition shall be active:

a. Summer mode is active in accordance with item 2.1

b. Outdoor air temperature is 5°F (2.8°C) or more below indoor average zone temperature

c. Indoor average zone temperature is greater than morning occupied heating set point

d. Local time is between 10:00 pm and 6:00 am.

2.3. When the night flush condition is active, automatic night flush controls shall operate outdoor air economizers with 100 percent outside air at low fan speed not exceeding 66% during the unoccupied period with mechanical cooling and heating locked out.

2.4. Alternatively, another night flush strategy shall be permitted where demonstrated to be effective, avoids added morning heating, and is approved by the authority having jurisdiction.

3. The project shall demonstrate a contractual obligation for post-occupancy commissioning and control tuning in the spring or fall season to tune the summer mode activation setpoints and occupied heating setpoint or other algorithms to achieve minimal morning heating due to night flush activation while maintaining comfort conditions. Commissioning shall include monitoring of time series space temperature, heating, and cooling operation to demonstrate both night cooling and minimization of morning heating along with

Commented [RH70]: This item is an additional requirement that requires the night flush controls be properly tuned once the building is occupied to avoid excessive heating during the morning warmup period.

It is more specific than the commissioning requirements in C408, but is in the same spirit as commissioning requirements in C408.

monitoring of post-tuning operation to verify tuned parameters. Operating manuals shall include recommendations for tuned parameters and narrative training for operating staff on night flush automated settings. Commissioning reporting shall be in compliance with Section C408.

Informative Note: The simplified night flush sequence described will operate in "summer mode" below the 70°F outdoor air trigger temperature down until outdoor air of 45°F is hit when the "summer mode" is deactivated until the outdoor air temperature rises above 70°F again. Other strategies may be implemented that cool the space below the heating setpoint and adjust the morning heating setpoint to avoid morning reheating.

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